

COMP 3400 Computational Logic and Automated Reasoning

Winter 2018 Assignment 1

Instructions:

1. **For your solution use the template file that was posted on the course news, and follow the instructions in it, and those here below.**

In particular: (a) Include at the top of the first page: full name, student number, and email address. (b) Assignments have to be created with Latex, and submitted in pdf format. (c) Every problem solution **MUST** include the problem statement as found below in this assignment. The source file for this assignment is provided. (d) Latex has to be used as such, not as a simple text editor, such as Notepad. Latex is much more than that. In particular, formulas have to be written using Latex's mathematical features, and then compiled.

2. Assignments are individual; no group work allowed.
3. Submit by email to the instructor (bertossi@scs.carleton.ca), with "Assignment "Number", CompLog" in the subject. **Include your last name in the file name!** For example, in the subject: "Assig. 1 CompLog". The file name: "bertossi-1.pdf".
4. **Only a single pdf file will be accepted as submission. No tar or zip files (or anything like that), please.**
5. **Keep your Latex source files, you may be requested to show them. The same applies to the whole interaction with the automated reasoner as text files.**
6. Explain your solution very carefully, but still be succinct in your answers. No unnecessary verbose arguments, please. Go to the point.
Make explicit all your assumptions.
7. **Not following the instructions above or the solution template file will make you lose points.**

1. Prove using **PROPOSITIONAL** logic and Prover9 (departing from any of these two requirements will give you automatically 0 points) that the map that includes only Chile, Peru, Argentina and Bolivia (cf. Fig. 1) cannot be painted with 2 colors if adjacent countries must have different colors. To simplify, assume that the colors are blue and green.

More precisely proceed as follows (and clearly include in your assignment report these three stages):

- (a) Write in propositional logic (with its usual notation for formulas and using Latex math mode), outside Prover9, the knowledge base.
- (b) Describe the methodology you will use to obtain your result and how Prover9 will help you in that regard, paying particular attention to the fact that Prover9 reasons by contradiction. All this before going into Prover9.
- (c) Do the proof with Prover9, and include in the main body of the report your input file, the clean/pruned proofs, AND an explanation of how you use those proofs to solve your problem.

The run and output text files provided by Prover9 have to included as an appendix, including all the formulas, the run, and the final clean proof. For this use Latex's "verbatim" environment that allows you to include text as it is in a document.



Figure 1: Map of South America

2. There are a golden box and silver box, both sealed. It is known that only one of them contains a diamond. Each of the boxes has a label on top, saying:

- Label on golden box: “The diamond is not here”.
- Label on silver box: “Exactly one of the labels is true”.

It is also known that at most one of the labels is true.

Use **PROPOSITIONAL logic** to represent in a knowledge base the information above, and use it to determine by means of Prover9 where the diamond is stored. More specifically:

- (a) Write a propositional knowledge basis describing the above situation. Explain.
- (b) Describe how to use Prover9 to deduce in which box is the diamond.
- (c) Use Prover9 to solve your problem; include the file and run as in problem 1; and explain what Prover9 did and how you use the result to solve the problem.

Deadline: Feb. 4, at 23:55